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(54) Method of protecting wall ties and a composition for same

(57) A method for protecting corroding wall ties involves removing mortar from the outer leaf brickwork to access the wall tie and then chemically treating the wall tie to inhibit further corrosion before remortaring the wall tie to the outer leaf. The treating involves using a composition containing an anti-corrosion agent and should be able to cover and seal the tie, as well as adhere to the surrounding mortar and brickwork. It should also be flexible enough to allow for the building's natural movement. A suitable composition comprises an intimate mixture of a siloxane, a cross-linking agent capable of cross-linking the siloxane, a catalyst capable of catalysing cross-linking of the siloxane by the cross-linking agent, a plasticiser, an anti-corrosion agent and a thixotropic agent.

-1-

DESCRIPTION

METHOD OF PROTECTING WALL TIES AND A

COMPOSITION FOR SAME

The present invention relates to a method of protecting wall ties and a composition for same.

Many houses were originally constructed with a single 9" solid wall. This wall was made up of two layers of 4.5" wide by 9" long brick. These were laid back to back for strength. Every few courses a row of bricks was placed across the two layers creating a bond between the inner leaf and the outer leaf, thereby giving the walls considerable strength.

Though this construction resulted in a solid wall structure capable of supporting the floors and roof of the building it did not keep water from penetrating the wall. Consequently the inwardly facing surface of the wall became damp.

Earlier this century it was decided to separate the inner leaf brick work from the outer leaf brick work thus creating a cavity. The idea was that this would then allow water to penetrate the outer leaf leaving the inner leaf damp free. However, in order for loads to be adequately supported, the inner leaf or main supporting structure needed to be connected to the outer leaf or cladding. This was achieved by

placing pieces of shaped metal across the cavity from the inner leaf to the outer leaf. These pieces of shaped metal were placed across beds of wet mortar whilst the building was being built, so as to create a tie between the two leaves. The pieces of metal (each usually shaped at both ends like a fish's tail so as to give extra gripping power) became known as wall ties, and were expected to last the lifetime of the building.

A few years ago it became apparent that cracks which had appeared on the outside of some houses were not simply due to long standing structural movement but were instead a result of the ties between the inner leaf and the outer leaf expanding as a result of corrosion. The corrosion was mainly occurring at the outer leaf and was probably the result of penetration by water or reaction with mortar. The resulting expansion of the wall ties led to pressure being exerted on the surrounding fabric of the building. This pressure had in some cases become so great that the bricks above the wall tie were lifted, creating the cracking that was visible from the outside. When the upward force resulting from expansion becomes greater than the downward force exerted by the weight of the building itself, the lack of an effective tie restraint results in the brick work deflecting

outwardly thus creating a bulge which undermines the strength of the building. In severe cases, the result is a collapse of the outer wall.

In order to try to solve the problem of wall tie failure, various types of stainless steel replacement wall ties have been used. These can retie the bond between the inner and outer leaf. They can be fitted quite easily and quickly between the two leaves from the outside. This action can avoid the costly job of rebuilding the outer leaf. They must however be fitted before distortion of the wall becomes too great and the old ties must be either removed or made ineffective.

Various methods have been used for the isolation or the removal of corroded or corroding ties, but all have major drawbacks.

One method involves freeing the ties by removing the mortar which surrounds the tie. A piece of dampproof course is rolled up and inserted inside a mortar joint so as to create a back pressure for the cosmetic repointing of the brickwork. This method allows the tie to expand into the void created but it also leaves a gap in the wall. This treatment can leave several hundred gaps in a house which in itself can lead to structural problems. Furthermore, it is still necessary to retie the inner and outer leaf.

Another method, which also requires the retying of the inner and outer leaf, involves the removal of a brick adjacent to the wall tie so as to provide access to the tie. The tie is then bent into the cavity or removed completely. The brick is then remortared back into place. This is an effective way of isolation but it is very time consuming and, due to the repointing necessary it can spoil the aesthetic appearance of the house. It is also difficult to mortar all the edges of a brick when refitting it. This can result in the brick being only partially seated in the walls when replaced. This reduces the structural strength.

It is one object of the present invention to provide a method which allows a tie to be treated without having to remove and replace bricks, thereby also alleviating the need to introduce replacement ties.

According to one aspect of the present invention there is provided a method of treating a corroding wall tie, which is located between the inner leaf and outer leaf of a building, the method comprising the steps of isolating the tie from the surrounding mortar of the outer leaf, chemically treating the tie to inhibit further corrosion and remortaring the tie to the outer leaf.

The isolation of the tie from the mortar of the outer leaf is preferably achieved by drilling or chipping away the mortar surrounding the tie.

The composition used to inhibit further corrosion should be a composition which can be easily applied to a tie through the aperture resulting from the removal of the mortar surrounding the tie. It should be able to cover and seal the tie and should adhere to the surrounding mortar and brick work to strengthen the building fabric. It should be flexible to allow for the buildings natural movement and should make inert any corrosion to the tie.

As another object of the invention there is provided a composition, for use in the treatment of corroding ties.

According to another aspect there is provided a composition for treating corroding metal, said composition comprising an intimate mixture of a siloxane, a cross-linking agent capable of cross-linking the siloxane, a catalyst capable of catalysing cross-linking of the siloxane by the cross-linking agent, a plasticiser, an anti-corrosion agent and a thixotropic agent.

The respective amounts of the components could vary depending on the particular choice of component. Thus for example, the anti-corrosion agent should be

provided in an effective amount. Similarly, the amount of catalyst will again be incorporated as an amount necessary to cause cross-linking of the siloxane with the cross-linking agent. Essentially, the catalyst will only catalise the cross-linking of the siloxane to the cross-linking agent when the composition is exposed to, for example, moisture of air so that polymerisation will only occur when the composition has been applied to, for example, a tie. The remaining components will be included in amounts sufficient to produce a desired consistency.

Thus, in one embodiment the siloxane and cross-linking agent will not react until, for example, they are exposed to atmospheric moisture when in the presence of the catalyst they will rapidly react to provide a suitable polymeric coat over the tie. The plasticisers present will serve to promote the adhesion properties of the finished product and provide the necessary elastic properties of the composition.

Fillers may be used to set the viscosity of the composition and may even control the sheer strength and hardness of the composition.

More preferably, the siloxane, cross-linking agent, catalyst, plasticizer, anti-corrosion agent and thixotropic agent are present at 20 to 50, 3 to 6,

0.5 to 4.5, 10 to 30, 2 to 10 and 3 to 6% by weight of the composition respectively.

The siloxane is preferably an α,ω -dihydroxy polydialkylsiloxane in which the alkyl groups can be the same or different and preferably each alkyl group contains from 1 to 2 carbon atoms. More preferably the siloxane is an α,ω -dihydroxypolydimethylsiloxane. The preferred relative molecular mass range of the siloxane is from 70,000 to 90,000 more preferably 80,000.

The cross-linking agent should be capable of cross-linking the siloxane when the composition is exposed to moisture.

Preferably the composition is an oxime curing system and therefore suitable cross-linking agents are e.g. silanes comprising an oximo or a ketoximo group.

A preferred cross-linking agent is methyl ethyl [methyl-ethyl ketoximo]silane. Using this cross-linking agent, cross-linking is, without being bound by theory, thought to occur by the reaction of the free Si-OH groups on either side of the siloxane chains reacting with the Si-OH groups of the cross-linker. The Si-OH groups of the cross-linker are initially blocked but are freed by a chemical reaction which takes place when the composition is exposed to atmospheric moisture.

With this cross linking agent ketoximes are thought to be released during cross-linking. The ketoximes have a pH of around 7.0 and do not adversely react with mortar.

Suitable catalysts are C₆₋₁₀ dialkylamines, such as dibutylamine, since these also function as anti-corrosion agents. Thus it is possible to reduce the amount of or dispense with altogether a separate anti-corrosion agent.

20-70% more preferably 40-60% w/v solutions of a siloxane in an alkylbenzene can also be used as catalysts. Particularly preferred is a 45 to 55% solution of "Siloxane NIP 8512" which can be obtained under that name from IMPEX-handel GmbH.

Desirably, a dialkylamine and a siloxane solution are present in the same composition as co-catalysts. Particularly effective co-catalysts are dibutylamine and siloxane NIP 8512 solution.

The plasticizers in the composition of the present invention contribute to the elasticity and/or adhesion of the composition when it is cured.

Alkylbenzene in which the alkyl group has from 1 to 20 carbon atoms are suitable plasticizers. Dodecylbenzene is particularly suitable.

Other plasticizers can be used either in combination with or instead of alkylbenzenes. These include dialkyl polydialkyl siloxanes. Such siloxanes have preferred relative molecular masses from 40,000 to 50,000. A preferred dialkyl polydialkyl siloxane is dimethyl polydimethyl siloxane. This acts to increase the elasticity of the cured composition and can be used together with dodecylbenzene, which has a similar function but is more effective in performance. Dodecylbenzene is however more expensive and consequently it is used primarily in combination with other plasticizers.

As described above, dialkylamines can be used as anti-corrosion agents (rust inhibitors). Also suitable are ferric anti-corrosion agents e.g. red iron oxide.

Silicon dioxide is a suitable thixotropic agent for use in a composition of the present invention.

Other substances can form part of the composition of the present invention as indicated below. The figures given in brackets (as for those given above) indicate suitable (but not necessarily limiting) percentages by weight with respect to the composition:-

Filler Material

This can be, if present:

PVC (0.1 to 50%/wt.), which is useful for increasing shear strength, viscosity and hardness.

Calcium carbonate (0.1 to 50%/wt.) which can be used as a general, cost effective, filler.

Glass bubbles of diameter of generally less than 0.74mm (0.1 to 30%/wt.) which can be used as a reinforcement for the final compound. They also serve to reduce the specific gravity of the product.

Adhesion Promoter

Substances can be used to promote and develop the final adhesion of the composition to a substrate. A suitable adhesion promoter is "Siloxon NIP 8511" (0.1 to 10%/wt.) which is obtainable under that name from IMPEX-handle GmbH.

Compositions of the present invention have excellent anti-corrosion properties and when cured maintain the wall tie function to support the walls. At the same time the wall ties remain flexible enough to allow for natural building movement (such compositions have a 5% - 10% deflection ratio). Furthermore compositions of the present invention generally have a pH around neutral (about pH 6 to pH 8) and therefore do not adversely react with mortar.

In one embodiment of the present invention a composition as hereinbefore described further comprises an epoxy resin. The epoxy resin can be present at from 30 to 50%/wt., preferably to 35-45%/WT.

The epoxy resin serves to increase the tensile strength of the cured composition, and compositions containing it are particularly suitable for treating metal in an advanced state of corrosion.

The composition can be applied by many methods as will be evident to those skilled in the art. For example the compositions can be brushed, sprayed or squirted onto a particular substrate. A preferred method of application however is by extrusion from an applicator gun.

This method is particularly suitable for the treatment of corroding cavity wall ties, since it can be used without removing any brick-work. It is only necessary to remove mortar from the exterior brick-work in the vicinity of a corroding tie (by e.g. drilling) to gain access to the tie. Old mortar can then be removed from around the tie and an applicator gun can be used to extrude the composition onto and around the tie to give a coating. This coating typically forms a skin after about 10-15 mins but

generally remains soft underneath the skin for 24 to 48 hours. This facilitates the action of the rust inhibitor. Final curing typically takes about 2 weeks.

Even if, on curing, the composition is not in contact with certain regions of the tie due to the presence of air bubbles, the composition can effectively alleviate further corrosion in these regions. This is possible because further corrosion leads to expansion of corroded regions of the tie, thereby bringing the expanded regions into contact with the anti-corrosion agent.

The composition of the invention, as well as adhering to corroding ties, will also adhere to the surrounding fabric of the building without any adverse chemical reaction. The resulting cured composition therefore makes a major contribution to the structural strength of the building.

It has been found that a composition with components within the ranges set out in Table 1 is particularly suitable for treating corroding cavity wall ties.

An embodiment of the present invention will now be described by way of example only with reference to Table 2 which shows a preferred composition of the invention.

Example

The components given in Table 2 at the given percentages by weight were mixed for 2 minutes at 20 rpm so that a substantially even consistency was obtained.

The resultant composition was not left to stand but was quickly used to fill 310 ml skeleton gun plastic cartridges. These cartridges were sealed, ensuring that no large air spaces were present within the cartridges.

To treat a wall tie, the tie is first detected. The ties are found bridging a cavity formed between an outer leaf and an inner leaf of a wall. The tie is embedded in mortar between respective courses of both the inner and outer leaves.

The tie is first isolated by removing the mortar from between the bricks surrounding the tie. They are attacked from the outer wall. This may be done by, for example, drilling out the mortar. Once isolated, the tie can be treated by applying a suitable chemical composition to the tie through the gap created on removing the mortar. The chemical composition may for example be the one described in Table 2. It is applied from a skeleton gun. The composition should be applied liberally so that all the exposed parts of

the tie are coated along with the adjacent brick work.

The composition first, after 10 to 20 minutes, forms an outer skin and the corrosion inhibitor within the composition is able to diffuse to the tie where it acts on any rust. Complete curing may take from several days to a few weeks.

After treatment is completed the gap can be remortared. The process is both quick and cheap to conduct and has the advantage that the ties are treated rather than made ineffective and replaced.

TABLE 1

| <u>Component</u> | <u>Percentage by weight of the Composition</u> |
|-------------------------------------------------------------------------------------|----------------------------------------------------|
| α , ω -dihydroxy polydimethyl) siloxane (molecular mass 80,000) | 20 to 30 |
| dimethylpolydimethyl siloxane (molecular mass 30,000) | 5 to 10 |
| Propyl benzene | 5 to 15 |
| Dodecylbenzene | 1 to 5 |
| PVC filler | 20 to 25 |
| Calcium Carbonate | 8 to 12 |
| Glass bubbles (Diameter of generally less than 0.74mm) | 0.5 to 5 |
| Red Iron Oxide | 1 to 5 |
| Pigment | 3 to 6 |
| Methylethyl(methyl ethyl Ketoximo) Silane | 3 to 6 |
| Silicone dioxide | 3 to 6 |
| Siloxon NIP 8511 | 0.1 to 4 |
| Dibutylamine | 0.1 to 4 |
| Siloxine NIP 8512 (as a 45-55% w/v solution in alkylbenzene) | 0.1 to 4 |

-16-
TABLE 2

| <u>Component</u> | <u>Percentage by weight of the composition</u> |
|-----------------------------------------------------------------------------------|----------------------------------------------------|
| γ , δ -dihydroxy polydimethylsiloxane (molecular mass 80,000) | 26.0 |
| Dimethylpolydimethylsiloxane (molecular mass 30,000) | 7.7 |
| Propyl benzene | 10.0 |
| Dodecylbenzene | 3.0 |
| PVC filler | 22.8 |
| Calcium carbonate | 11.8 |
| Glass bubbles (Diameter less than 0.74mm) | 2.0 |
| Red Iron Oxide | 4.0 |
| Pigment | 1.0 |
| Methylethyl[methyl ethyl ketoximo] silane | 4.8 |
| Silicon dioxide | 4.5 |
| Siloxon NIP 8511 | 1.0 |
| Dibutylamine | 0.4 |
| Siloxane NIP 8512 (as a 50% w/v solution in alkylbenzene) | 1.0 |
| ----- | |

-17-
CLAIMS

1. A method of treating a corroding wall tie which is located between an inner leaf and outer leaf of a building, the method comprising the steps of isolating the wall tie from the surrounding mortar of the outer leaf, chemically treating the wall tie to inhibit further corrosion and remortaring the wall tie to the outer leaf.

2. A method as claimed in claim 1, in which the step of isolating the wall tie comprises drilling or chipping away the mortar surrounding the wall tie.

3. A method as claimed in claim 1 or 2, in which the wall tie is chemically treated through an aperture formed by removing mortar from between adjacent bricks of the outer leaf.

4. A method as claimed in any of the preceding claims, in which the isolated wall tie is covered and sealed with a corrosion inhibiting composition.

5. A method as claimed in claim 4, in which the composition is applied by brushing, spraying, squirting or extruding it on to the wall tie.

6. A composition for treating corroding metal, said composition comprising an intimate mixture of a siloxane, a cross-linking agent capable of cross-linking the siloxane, a catalyst capable of catalysing cross-linking of the siloxane by the cross linking

agent, a plasticiser, an anti-corrosion agent, a thixotropic agent, and optionally a filler.

7. A composition as claimed in claim 6, in which the components of the composition are present in the range as follows:

| | |
|----------------------|----------------------|
| Siloxane | 20 - 50% by weight |
| Cross-linking agent | 3 - 6% by weight |
| Catalyst | 0.5 - 4.5% by weight |
| Plasticiser | 10 - 30% by weight |
| Anti-corrosion agent | 2 - 10% by weight |
| Thixotropic agent | 3 - 6% by weight |
| Filler | 0 - 50% by weight |

8. A composition as claimed in claims 6 or 7, in which said catalyst catalyses the cross-linking of the siloxane to the cross-linking agent in the presence of atmospheric moisture.

9. A composition as claimed in any of claims 6, 7 or 8, in which said siloxane is an α , 0 dihydroxypolydialkylsiloxane in which the alkyl groups are the same or different and each contains from 1 - 2 carbon atoms.

10. A composition as claimed in claim 9, wherein the siloxane is an α , 0 dihydroxypolydimethylsiloxane.

11. A composition as claimed in claim 9 or 10, wherein the siloxane has a molecular weight from 70,000 to 90,000.

12. A composition as claimed in any of claims 6 to 11, in which the cross-linking agent is a silane.

13. A composition as claimed in claim 12, wherein the silane comprises an oximo or ketoximo group.

14. A composition as claimed in claim 13, wherein the silane is methyl ethyl (methyl ethyl ketoximo) silane.

15. A composition as claimed in any of the claims 6 to 14, in which the catalyst is a C₆₋₁₀ dialkylamine.

16. A composition as claimed in claim 15, in which the dialkylamine is dibutylamine.

17. A composition as claimed in any of claims 6 to 16, in which the catalyst is a 20 - 70% W/V solution of siloxane in an alkylbenzene.

18. A composition as claimed in claim 17, in which the catalyst is siloxane NIP 8512.

19. A composition as claimed in any of claims 6 to 18, in which the plasticizer is an alkylbenzene in which the alkyl group has from 1 - 20 carbon atoms.

20. A composition as claimed in claim 19, wherein the plasticizer is dodecylbenzene.

21. A composition as claimed in claim 19, in which the plasticizer is a dialkyl polydialkyl siloxane.

22. A composition as claimed in claim 21, in which the plasticizer is a dialkyl polydialkyl

siloxane.

22. A composition as claimed in claim 21, in which the plasticizer has a molecular mass of from 40,000 to 50,000.

23. A composition as claimed in claim 21 or 22, in which the dialkyl polydialkyl siloxane is dimethyl polydimethyl siloxane.

24. A composition as claimed in any of claims 6 to 23, in which the anticorrosion agent is a dialkylamine or red iron oxide.

25. A composition as claimed in any of claims 6 to 24, in which the thixotropic agent is silicon dioxide.

26. A composition as claimed in any of claims 6 to 25, in which the filler is either PVC, calcium carbonate or glass bubbles having a diameter of generally less than 0.74 mm.

27. A composition as claimed in any of claims 6 to 26, which further comprises an adhesion promoter.

28. A composition as claimed in claim 27, in which the adhesion promoter is siloxon NIP 8511.

29. A composition as claimed in claims 27 or 28, in which the adhesion promoter is present in an amount from 0.1 - 10% by weight.

30. A composition as claimed in any of claims 6 to 29, which further comprises an epoxy resin.

-21-

31. A composition as claimed in claim 30, in which the epoxy resin is present in an amount of from 30 - 50% by weight.

Patents Act 1977

Examiner's report to the Comptroller under
Section 17 (The Search Report)

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Relevant Technical fields

(i) UK CI (Edition K) E1S (SAW)

(ii) Int CL (Edition 5) E04G

Search Examiner

A H MITCHELL

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASE: WPI

Date of Search

15 APRIL 1992

Documents considered relevant following a search in respect of claims

1-5

| Category (see over) | Identity of document and relevant passages | Relevant to claim(s) |
|------------------------|------------------------------------------------|-------------------------|
| X | GB 2179990 A (CLAN) note page 2 lines 40-47 | 1-4 |

| Category | Identity of document and relevant passages | Relevant to claim(s) |
|----------|--------------------------------------------|----------------------|
| | | |

Categories of documents

X: Document Indicating lack of novelty or of inventive step.

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